CLAIMS

WE CLAIM:

1. An agropolymer comprising a carbohydrate and/or silica matrix obtained from an agricultural crop selected from the group consisting of *Oryza sativa, Panicum miliaceum, Setaria italica, Cajanus cajan, Vigna mungo, Vigna radiata, Triticum sp., Ricinus communis, Helianthus annus, Gossypium sp.*, and *Arachis sp*, said carbohydrate and/or silica matrix being substantially devoid of proteins, tannins and polyphenols, said matrix further comprising metal binding reactive sites.

2. The agropolymer of claim 1, wherein said carbohydrate and/or silica matrix is obtained from plant parts of said agricultural crop, said plant parts being selected from the group consisting of seed coats, seed covers, hulls, and husks.

3. The agropolymer of claim 2, wherein said plant parts are micronized, and wherein said micronized plant parts are treated with ferric chloride and dried, said treated micronized plant parts subsequently being subjected to infrared spectroscopy, thereby revealing reactive, organometallic bonds.

4. The agropolymer of claim 3, wherein said plant parts are derived from a husk of *Triticum sp*, and wherein said plant parts, after undergoing infrared spectroscopy reveal organometallic bonds at 2360 ± 10 and 2340 ± 10 wave numbers (cm^{-1}).

5. The agropolymer of claim 3, wherein said plant parts are derived from a member of the group consisting of a seed coat of *Gossypium sp* and a seed coat of *Vigna radiata*, and wherein said plant parts, after first undergoing alkaline hydrogen peroxide treatment, reveal organometallic bonds, through infrared spectroscopy at 2360 ± 10 and 2340 ± 10 wave numbers (cm^{-1}).

6. The agropolymer of claim 3, wherein said plant parts are derived from a member of the group consisting of a seed coat of *Panicum miliaceum*, a seed coat of *Setaria italica*, a seed coat of *Cajanus cajan*, a seed coat of *Vigna mungo*, a seed coat of *Ricinus communis*, and a seed coat of *Helianthus annus*, and wherein said plant parts, after first undergoing alkaline hydrogen peroxide treatment, reveal organometallic bonds characteristic of said plant parts.

7. A method of producing an agropolymer comprising a carbohydrate matrix obtained from plant parts of an agricultural crop, said agricultural crop selected from the group consisting of *Oryza sativa, Panicum miliaceum, Setaria italica, Cajanus cajan, Vigna mungo, Vigna radiata, Triticum sp., Ricinus communis, Helianthus annus, Gossypium sp.*, and *Arachis sp*, said carbohydrate matrix being substantially devoid of proteins, tannins and polyphenols, said matrix further comprising metal binding reactive sites, said method comprising:

a. powdering said plant parts;

b. micronizing said plant parts to a desired particle size;

c. treating said micronized plant parts with either an alkaline treatment, a hydrogen peroxide treatment, or a combination of an alkaline treatment and a hydrogen peroxide treatment;

d. further treating said plant parts with repeated washings of either water or an acid solution, said washings with water or acid solution serving to remove alkaline and/or hydrogen peroxide residue;

e. further treating said plant parts with an acid solution, said acid solution serving to remove metals bound to said treated plant parts;

f. neutralizing said plant parts by removing remaining acid residue through water washings or through the addition of a diluted alkaline solution; and

g. drying the resulting agropolymer, derived from said plant parts.

8. The method of claim 7, wherein said powdering of said plant parts is performed by a grinder.

9. The method of claim 7, wherein said micronizing of said powdered plant parts is effected using a micronizer in order to obtain desired particle size.

10. The method of claim 7, wherein said plant parts of said agricultural crop are selected from the group consisting of seed coats, seed covers, husks, and hulls.

11. The method of claim 7, wherein treating said micronized plant parts with said combination of an alkaline treatment and a hydrogen peroxide treatment is effected by first treating said micronized plant parts with sodium carbonate and subsequently treating said micronized plant parts with hydrogen peroxide.

12. The method of claim 7, wherein treating said micronized plant parts with said alkaline treatment is effected by adding an alkaline solution to said micronized plant parts of said agricultural crop.

13. The method of claim 7, wherein treating said micronized plant parts with said alkaline treatment is effected by adding alkaline powder or flakes directly to said micronized plant parts and subsequently adding water.

14. The method of claim 7, wherein said alkaline and/or hydrogen peroxide residue is removed by the addition of an acid solution, said acid solution being selected from the group consisting of a sulfuric acid solution, a hydrochloric acid solution, and a nitric acid solution.

15. The method of claim 7, wherein said bound metals present in said treated plant parts are removed with the addition of an acid solution, said acid solution being selected from the group consisting of 1% to 3% by weight solutions of sulfuric acid, hydrochloric acid, and nitric acid.

16. The method of claim 7, wherein said treated plant parts are neutralized to remove remaining acid residue through the addition of a diluted alkaline solution, said alkaline solution being selected from the group consisting of a sodium hydroxide solution and a potassium hydroxide solution.

17. The method of claim 7, wherein said drying of said resulting agropolymer is effected by decanting off the supernatant and drying the molecules of said resulting agropolymer in a dryer at a temperature of from about 70 °C to about 80°C.

18. The method of claim 7, wherein said drying of said resulting agropolymer is effected by decanting off the supernatant and drying the molecules of said resulting agropolymer at room temperature.

19. A method of purifying aqueous solutions contaminated or polluted with metals or ions, said aqueous solutions including drinking water and ground water, said method comprising treating said aqueous solutions with a metal-impregnated agropolymer and/or an agropolymer comprising a carbohydrate and/or silica matrix, said matrix being substantially devoid of proteins, tannins and polyphenols, said matrix further comprising metal binding reactive sites, said metal-impregnated agropolymer or said agropolymer originating from plant parts, said plant parts including seed coats, seed covers, husks, or hulls of an agricultural crop, said agricultural crop being selected from the group consisting of *Oryza sativa, Panicum miliaceum, Setaria italica, Cajanus cajan, Vigna mungo, Vigna radiata, Triticum sp., Ricinus communis, Helianthus annus, Gossypium sp.*, and *Arachis sp.*, said method comprising contacting said aqueous solutions with said metal-impregnated agropolymer and/or said agropolymer using a column or batch mode, said metals or ions thereby being sequestered by

said metal-impregnated agropolymer and/or said agropolymer, whereby the aqueous solutions are purified of said metals or ions.

20. The method of claim 19, wherein said metal-impregnated agropolymer or said agropolymer removes arsenic from said aqueous solutions.

21. The method of claim 19, wherein said metal-impregnated agropolymer or said agropolymer is used to treat natural ground water, said ground water being rich in toxic metals, said treatment with said metal-impregnated agropolymer or said agropolymer resulting in substantially pure or potable water.

22. The method of claim 21, wherein said toxic metals include arsenic and mercury.

23. The method of claim 19, wherein said metal-impregnated agropolymer or said agropolymer is used to prevent contamination of ground water by said metals or ions in an industrial site or a water treatment plant.